Amendments to the Specification:

[0005] In the case of a digital transmitter, the standard to which it is targeted typically specifies requirements for the modulation of the data and generation of the output signal. The Bluetooth 1.1 specification describes a frequency modulation scheme having a hopping sequence of 79 channels in the 2.4 GHz ISM frequency range. A problem arises in that modulation inaccuracies and phase noise on the oscillator ~~used to~~ that generate the ~~frequency~~ RF carrier translate, after frequency demodulation at the receiver, to distortion and additive baseband noise, which could degrade the receiver's performance. Therefore, transmitters must be tested for compliance against the defined modulation quality criteria, which specifies the limits on the amount of distortion and noise in their circuitry.

[0007] In addition, frequency droop is permitted to a certain extent by the Bluetooth specification. The amount of frequency droop permitted is 25 kHz for short packets (single time slot of 625 μsec) and 40 kHz for long packets (3-5 slots). It is noted that some open loop modulators operate by remaining closed loop until data is to be transmitted at which time they open the loop and modulate the oscillator with the packet's data, potentially resulting in frequency droop throughout the payload.

[0008] In light of the requirements of the Bluetooth specification described above, the modulation test used by the qualification test equipment [[was]] is defined such that the 'average (or instantaneous) center frequency is determined by averaging over eight symbols (i.e. 8 μsec) preceding the tested sample. The samples are taken at the centers of the symbols where frequency deviation is maximal. The tested sample is then required to be within at least 115 kHz

frequency distance from that instantaneous center frequency. Only one per 1000 samples is permitted to fail this criterion. The result of this test is either a pass or fail indication.

[0011] The present invention ~~solves the problems of the prior art by providing~~ provides a mechanism for estimating the modulation noise in a transmitter to determine whether it complies with a certain allowed limit defined by a standard or by the device's specifications. The on-chip modulation noise estimation mechanism (MNEM) of the present invention is adapted to provide the same pass/fail indication [[as]] that would be provided by alternative external test equipment of high cost thus reliably determining whether a component would or would not qualify under the standard or targeted modulation and/or phase noise specifications. It does not, however, perform the test in the same manner as the prior art test equipment described in the Background Section hereinabove. This is because analysis preformed directly on the high frequency modulated signal is very difficult and/or costly in practice.

[0012] The present invention is ~~operative~~ suitable for use in devices that employ closed loop or so-called 2-point modulation architectures in their transmitters. Such modulation schemes use direct oscillator modulation with a phase locked loop (PLL) to maintain frequency stability. In these closed loop designs, the baseband signal to be transmitted is fed [[into]] to two points in the loop: ~~one point is~~ the reference input and the ~~second point is the~~ RF section. In such a structure, the error signal of the PLL reflects the amount by which the phase of the RF oscillator deviates from the phase trajectory dictated by the modulating signal, thus making this signal useful for the evaluation of modulation distortion and oscillator phase noise.

[0032] To aid in understanding the principles of the present invention, the description is provided in the context of a transceiver adapted to comply with the Bluetooth standard. It is

appreciated, however, that the invention is not limited to use with Bluetooth compliant devices but can be applied to devices adapted to comply with other ~~standard~~ standards as well, such as GSM. In addition, the invention is not limited to use with the transmitter modulation scheme presented herein but is applicable to any modulation scheme where the modulation itself is normally not present at the output of the phase detector when the loop is in lock. The invention can be used to ensure that the modulation quality complies with a given set of requirements whether part of a standard or not.